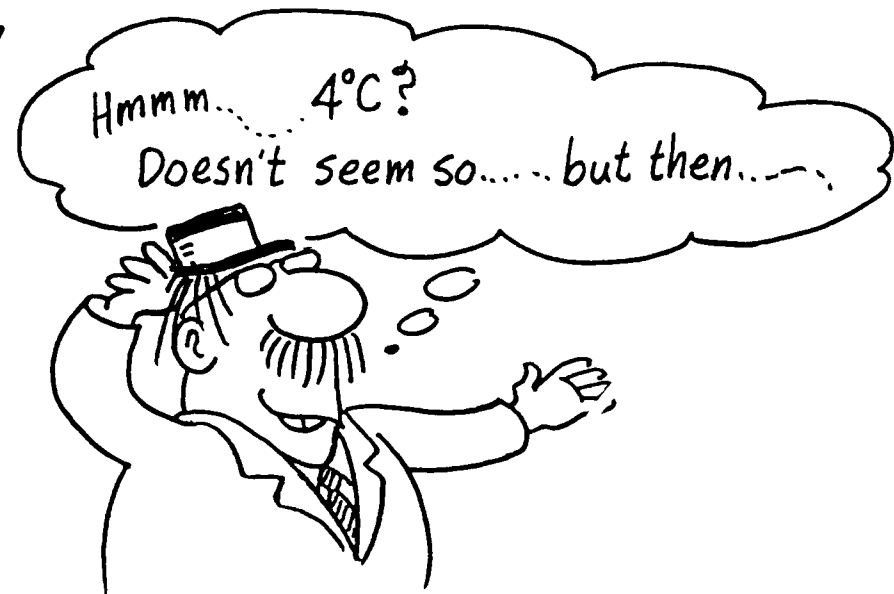


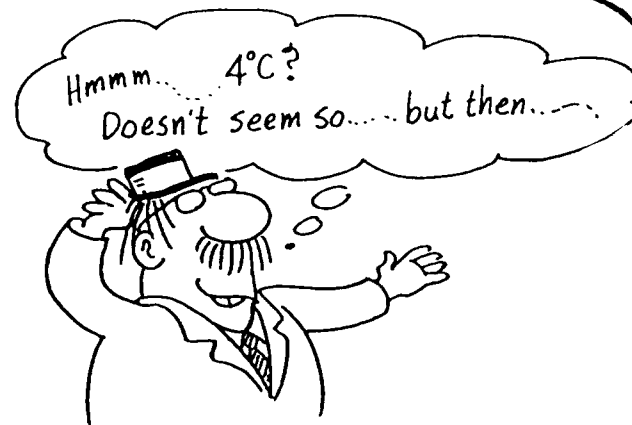
Next-Time Question

Helium has the special property that its internal energy is directly proportional to its absolute temperature. Consider a flask of helium with a temperature of 2°C . If it is heated until it has twice the internal energy, what will its temperature be?



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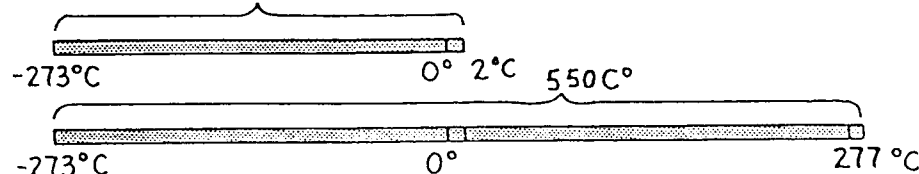


Answer:

Its temperature will be 277°C , and most certainly not 4°C ! At twice the internal energy, the gas will have twice the absolute temperature. Its initial absolute temperature is $273 + 2 = 275\text{ K}$. Twice this is 550 K . Expressed in Celsius, $550 - 273 = 277^{\circ}\text{C}$.



Consider a stick that is $273 + 2 = 275$ units long. This is like a thermometer that extends from absolute zero (-273°C) to 2°C . Can you see that a stick twice as long is $2(275)$ units long?

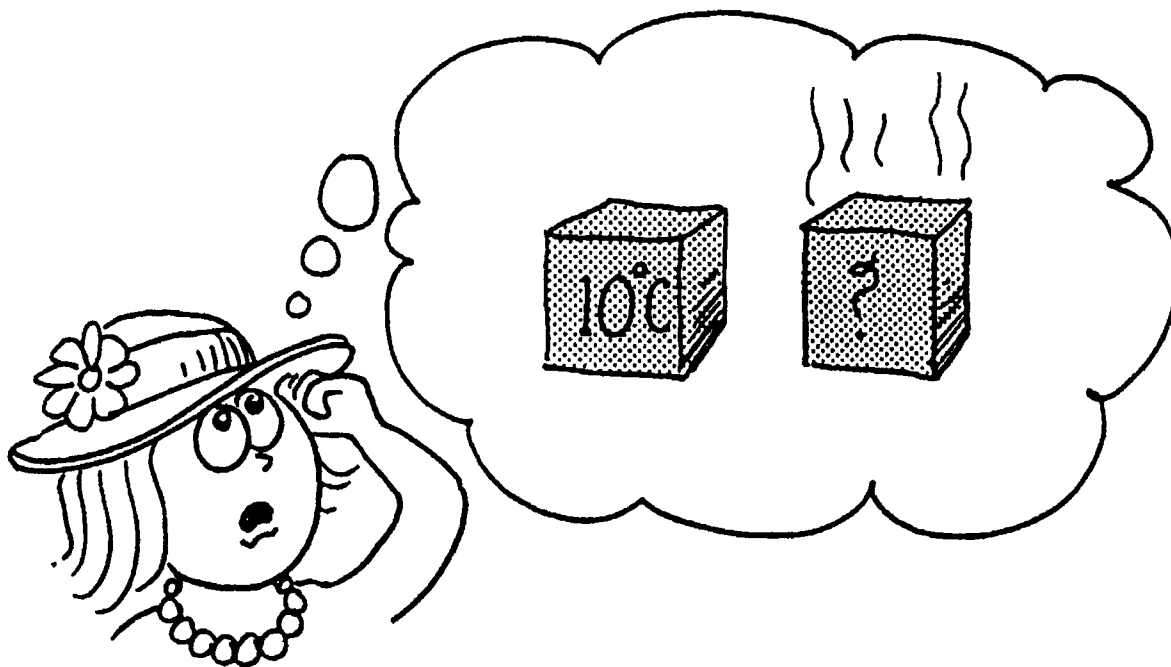


Or temperature-wise, 550 K ? Subtract the 273 part and you have 277 units - likewise for the twice-as-hot helium.

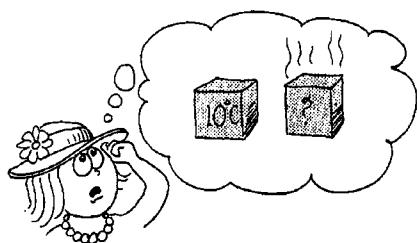
Hewitt
draw it!

Next-Time Question

A PIECE OF IRON HAS A TEMPERATURE OF 10°C . A SECOND IDENTICAL PIECE OF IRON IS TWICE AS HOT. WHAT IS THE TEMPERATURE OF THE SECOND PIECE OF IRON?



Next-Time Question

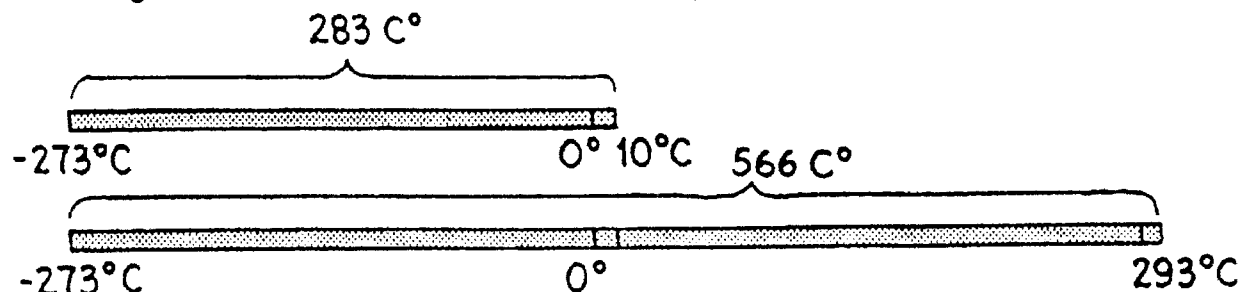


A PIECE OF IRON HAS A TEMPERATURE OF 10°C . A SECOND IDENTICAL PIECE OF IRON IS TWICE AS HOT. WHAT IS THE TEMPERATURE OF THE SECOND PIECE OF IRON?

Answer: 239°C

The twice-as hot iron is 239°C .

Consider a stick that is $273 + 10$ units long. This is like a thermometer that extends from absolute zero (-273°C) to 10°C . Can you see that a stick twice as long is $2 \times 283 = 566$ units long? (Or temperature-wise, 566 K ?)

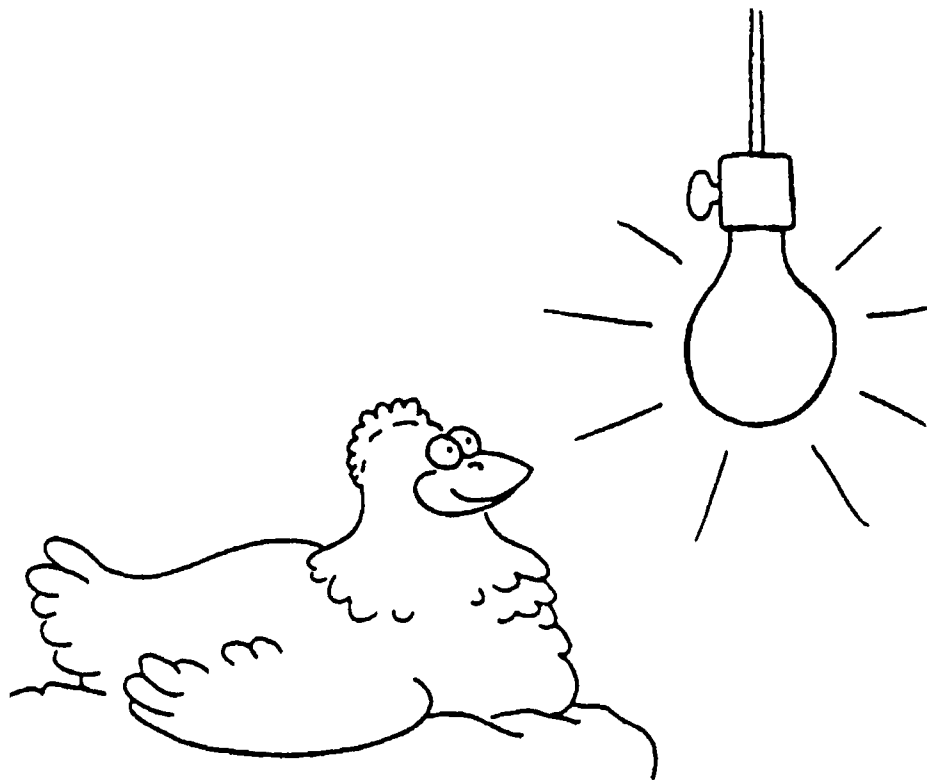


Subtract the 273 part and you have $566 - 273 = 293$ units—likewise for the twice-as-hot 10°C .

Hewitt
Drew it!

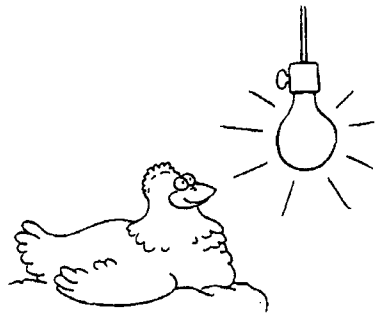
Next-Time Question

THE EFFICIENCY OF A COMMON INCANDESCENT LAMP FOR CONVERTING ELECTRICAL ENERGY INTO HEAT IS ABOUT



- a) 5%.
- b) 0%.
- c) 100%.

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FOR CONVERTING ELECTRICAL ENERGY INTO HEAT IS ABOUT

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- b) 0%.
- c) 100%.

Answer: c

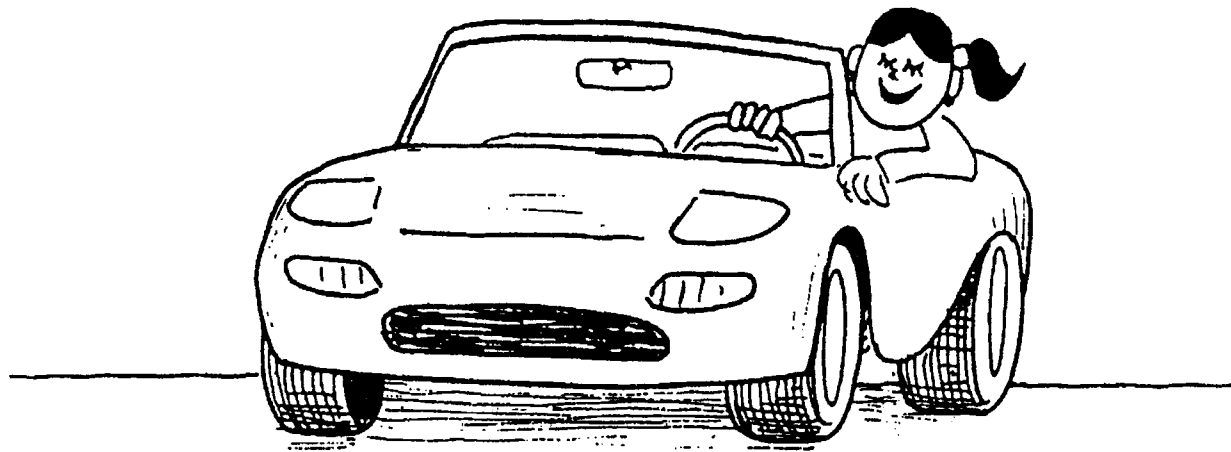
Although its efficiency for converting electrical energy into light is about 5%, all the energy dissipated by the lamp, even that momentarily converted to light, becomes heat.

That's why it isn't wasteful to keep
the lights on in a building that is
being electrically heated!



Hewitt
Drew it!

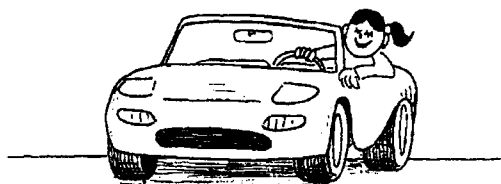
NEXT-TIME QUESTION



NELLIE KNOWITAL SAYS THAT THE GASOLINE IN AN AUTOMOBILE'S GAS TANK IS ONLY ABOUT ONE-FOURTH THE AMOUNT OF FUEL THAT RUNS THE ENGINE. IS SHE CORRECT? DEFEND OR REFUTE NELLIE'S STATEMENT.

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Draw it!

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Answer:

"Fuel" usually means the material that combusts with oxygen. So in this sense, an automobile gasoline tank contains all the fuel. But if "fuel" is meant to be all the material that feeds combustion, then Nellie is correct. Internal combustion engines normally run one part gasoline to fourteen parts air by mass. About 21% of the air is oxygen, which means about three parts oxygen by mass to one part gasoline. Since there is so much oxygen in the air, it needn't be put in a tank.



The fact that most of an engine's fuel is atmospheric oxygen is evident when a helicopter or plane cruises over an active volcano. When flying through a region of volcanic gases deplete in oxygen, the engine runs out of "fuel" and conks out even though the gasoline tank may be full!

The amount of oxygen decreases with altitude, which is often compensated for in aircraft by superchargers that supply increased amounts of air to the engines.



When hydrogen replaces gasoline in tomorrow's cars, what percentage of fuel will be atmospheric oxygen? Will these engines guzzle more or less oxygen?



Hewitt
Drewitt!